

CLAIMS

What is claimed is:

1. An acoustic wave sensor comprising:
a substrate formed from a piezoelectric crystal, said substrate having a sensing surface and a reference surface, said reference surface being opposite from said sensing surface, said sensing surface adapted to be immersed in an environment containing a measurand of interest; and
a pair of electrodes deposited upon said substrate reference surface, said electrodes separated by a gap and operative to generate a lateral electric field therebetween, said lateral electric field inducing transverse shear mode acoustic wave within said.
2. The sensor according to claim 1 wherein said substrate piezoelectric crystal is one of the group of quartz, langatate, langasite, langanite, lithium tantalate and lithium niobate.
3. The sensor according to claim 2 wherein said substrate is formed from an AT cut quartz .
4. The sensor according to claim 2 wherein said substrate is formed with a crystallographic orientation that would support propagation of only transverse shear mode acoustic waves.
5. The sensor according to claim 4 wherein said electrodes are formed with parallel facing edges that also are parallel with the crystallographic x-axis of said substrate such that upon excitation said electrodes generate an electric field that excites only transverse shear mode acoustic waves.

6. The sensor according to claim 5 wherein said electrodes are formed from one of the group of gold, platinum, palladium, silver, copper and aluminum.

7. The sensor according to claim 6 further including an adhesive layer formed from one of the group of chromium, zirconium, and titanium disposed between said electrodes and said reference surface of said substrate.

8. The sensor according to claim 7 wherein said gap between said pair of electrodes is within the range of 1.0 to 4.0 mm.

9. The sensor according to claim 8 wherein said substrate is circular in shape with a diameter within a range of 20 to 30 mm and a thickness within a range of 0.3 to 1.0 mm.

10. The sensor according to claim 9 wherein said electrodes have a thickness within the range of 1,500 to 2,500 Å and said adhesive layer has a thickness within the range of 50 to 150 Å.

11. The sensor according to claim 9 wherein said electrodes have a thickness that is less than 1,500 Å and said adhesive layer has a thickness that is less than 150 Å.

12. The sensor according to claim 8 further including a layer of a sorbent material deposited upon said sensing surface, said sorbent material being selected to absorb a measurand contained within the environment being sensed, said absorbed measurand changing an operative characteristic of the sensor such that the change in said operative characteristic can be correlated with said measurand.

13. The sensor according to claim 12 wherein said operative characteristic is the resonant frequency of the sensor.

14. The sensor according to claim 8 wherein said sensing surface is bare.
15. A method for fabricating a surface acoustic wave sensor comprising the steps of:
- (a) providing a piezoelectric crystal selected from the group of quartz, langatate, langasite, langanite, lithium tantalate and lithium niobate;
 - (b) forming the crystal into a substrate that includes a reference surface and a sensing surface opposite from the reference surface, the sensing surface adapted to be immersed in an environment containing a measurand of interest;
 - (c) depositing an adhesive layer upon the reference surface of the sensor substrate; and
 - (d) depositing a pair of electrodes formed from one of the group of gold, platinum, palladium, silver, copper and aluminum upon the reference surface of the sensor substrate and over the adhesive layer.
16. The method according to claim 15 wherein step (b) includes forming the substrate with an appropriate orientation of the piezoelectric crystal such that only transverse shear mode acoustic waves are propagated.
17. The method according to claim 15 wherein step (b) includes forming the substrate and step (c) includes orienting the electrodes upon the substrate such that, upon excitation of the electrodes, a lateral electric field is established therebetween.
18. An apparatus for measuring a characteristic of an environment comprising;
- an acoustic wave sensor having a piezoelectric substrate formed from one of the group of quartz, langatate, langasite, langanite, lithium tantalate and lithium niobate, said substrate having including a reference surface and a sensing surface opposite from said reference surface, said sensing surface adapted to be immersed in an

environment that contains a measurand, and pair of electrodes deposited upon said reference surface of said substrate;

a variable voltage supply electrically connected to said sensor electrodes and operative to cause said electrodes to generate a lateral electric field therebetween that produces transverse shear mode acoustic waves within said substrate that extend into said environment, said variable voltage supply having a variable frequency and being operative to sweep through a predetermined frequency range; and

a device electrically connected to said sensor and operative to detect the resonance frequency of the sensor, said device being further operative to detect shifts in the resonant frequency caused by said measurand deposited upon said sensing surface varies and to correlate said resonant frequency shift with said measurand.

19. The apparatus according to claim 18 further including an adhesive layer formed from one of the group of chromium, zirconium and titanium deposited between said substrate reference surface and said electrodes.

20. The apparatus according to claim 19 wherein said environment is a liquid and said measurand is the viscosity of said liquid.

21. The apparatus according to claim 19 wherein said environment is a liquid and said measurand is the relative permittivity of said liquid.

22. The apparatus according to claim 19 wherein said environment is a liquid characteristic and said measurand is the conductivity of said liquid.